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Let's take it from your recollection.

All right. To understand context, it's very important to realize two things. First of all, this was at a time when you could not interact with computers by and large. That is to say if you wanted to use a computer in the days that we started this project, you had to go punch holes in cards, in a deck of cards, and take the deck of cards to a computer operator. You know that routine?

Uh-huh, batch processing.

Right. So there was no interaction to speak of with the computer, first, and secondly, there was a large computing establishment at the time that was vested in that technology. So interactive -- anything smacking of interactive computing technology -- was [an *anathema* ethma(?)] to the established community. And that meant the large manufacturers and the large computer center operators. And thirdly, there was computer to computer communication, but it was all batch, and it was only possible between identical machines. Not even necessarily machines of the same manufacturer. They had to be the same model number. So that's the context of which you find yourself typically in the early and mid-60's.

Now time sharing, which was started by Arpa and Lic Lighter(?), by and large, in '62-'63 time period, at two or three research centers mainly MIT, Berkley, System Development Corporation in Santa Monica, California, were all under Arpa support. And just previous to that under Lic Lighter's direction, a small group ... began in the early 60's to build experimental timesharing systems. And around each of these experimental timesharing systems there collected a small set of users who were sort of the first folks who were interacting with the computer. They would sit at the keyboard and they would type. The computer would come back to them right away and they would type something else. You could actually build programs, de-bug them, run them. But this was a very small set of people in research environments, and by and large, the people [on *in mass* MOS] who use computers knew nothing of any of this. [This was a rare world.] However, around each of these timesharing systems interesting sociological phenomenon occurred. That is that

Summary Document

initially the group of people using these experimental systems as they began to come alive was very small. Two or three, four to five people. But then it began to grow. That is as the systems became robust enough and as they figured out their scheduling logarithms well enough you could add a few more users to each system. So imagine yourself as being at one of this places -- Bolt, Beranik & Newman, MIT, Berkley, System Development Corporation -- and one of your colleagues says, "Well, there's this new experimental computer system that they're fooling with over in the next group and they're looking for early users -- experimental users. And someone knows that you use a computer for something. Who knows what. Would you be interested?" So you say, "Okay, sure. I'll try anything. Better than punching holes in cards." So you're given a terminal and you sign onto this thing, and now you realize once you're in it, that there are a bunch of tools that are available to you. But you don't know how to use them. And it's the documentation about how to use these things is sometimes good and sometimes not existent and sometimes poor. And so you find yourself having to contact other people to figure out how to use this de-bugger or how to use this particular feature over here. And that means now you're building a community. That is, you're a part of a building community that didn't exist before. So around each of these experimental systems, communities grew up, and the thing that bound them together was a common need to share information about how to get done what they wanted to get done with this experimental system. So E-Mail was an obvious connecting element, with a telephone and with face to face, around each of these systems. But the communities were always limited within the geography that was served by that particular system. And at Bolt, Beranek & Newman, that was Bolt, Beranek & Newman, and at MIT, that was MIT, and so on. So the communities were bounded by geography and they were also bounded by number of simultaneous users that each of the early timesharing systems could support, which was relatively small. Which is why they used to say that timesharing systems ran faster at night than in the daytime. Okay. So the time now is 1965. I'm in Arpa.

How did you get to Arpa?

That's a digression. Short story. How to tell it shortly. Well let's see. When I was in graduate school, I did work in

psychoacoustics. Lic Lighter was famous in psychoacoustics. In 1961, I guess or '62, I took a job as a program manager in NASA Headquarters Research Operation. One of my research contracts that I was sponsoring out of this group was with Doug Englebart at SRI.

* { The mouse was invented under a NASA contract that I led. That's an interesting spin-off story that NASA has never made any hay out of. You know, they're always trying to sell folks on the importance of investing in NASA because you get Teflon for frying pans and stuff like that. There's a mouse. It's a secret. Anyway, so I was doing this in NASA headquarters -- and had been for a year or three. I can't remember exactly when, how long, when Lic Lighter came to Arpa. Lic Lighter formed a group of people in the government who were supporting computer research, so we could share notes, compare programs, not duplicate one another's money. That sort of thing. And I was one of those people. And he knew of my work from when I was in graduate school and we got to know each other. So he then recruited Ivan Sutherland to be his successor and he and Ivan recruited me to be Ivan's deputy and when Ivan left after a year, I took Ivan's place, and I stayed there for about five years.

So in '65, while Ivan was still there ^{nominaly} (anomaly), but in fact, he was mostly at Harvard or doing some work out at the National Security Agency, and sort of left running things up to me for the most part. I had the following situation. Our offices were in the Pentagon. I had a room off of my office which had three terminals in it. One terminal to MIT, one terminal to Berkley, and one terminal to SDC. This is ..., and these three terminals were all incompatible one with the other -- all different. And the stuff that I had to do to sit down to connect to one of these systems -- we were sponsoring work in all of these three places. That's why we had these terminals. And the protocol and all that I had to go through was all separate, and it was ridiculous, and the obvious idea was, wait a minute. Why don't we use computer technology to make it possible for anyone at any of these three places to connect with any one at any of the other two places, (A). (B) there are different computers in all three of these places. How are you going to get different computers to talk to one another? Well that's what a computer is for. A computer is an encoder/decoder. All right? And the reason that computers can't talk to one another is simply a coding problem. So let's address that problem while we're at it.

So I started talking to -- all right. To make this happen, I needed to have cooperation from my contractors. That is, the places which I was funding had groups of people at them. They were my users. I had to have their cooperation. So I began talking to various people at these sites. I also talked to some other folks. Two people of the ones I talked with were encouraging right off the bat. One was Lic Lighter and one was Wes Clark. And almost everybody else I talked to was either negative or lukewarm. Typical reaction of someone who would be a principle investigator at one of Arpa's research places -- not necessarily Berkley or any one of these first three that I mentioned, but typical of many places was, "Well, now wait a minute. If my computing facility is going to be available to people coming in over this network from other places, I'm going to have fewer computing cycles for my own people. Isn't that right? So are you going to buy me, Mr. Arpa, an additional computer? I mean, how are you gonna make this up to me?" And I would say, "Well, I'm not gonna make it up to you. This is an opportunity to do something that will give a lot of people a lot of leverage." And so I just had to sort of -- I could have said, "Look, you either cooperate with me or I'll take my money and go home." / But that's not gonna get cooperation. You know, I had to convince people. Get them into a state where they said, "Yeah, okay, that's pretty interesting. I think I'd like to be a part of that." More than just -- beyond just using their computing cycles, a fair amount of work -- design work and coding -- had to be done at each site. We'll get into that. Maybe you already understand that from understanding how the network was designed. But there's a BBN inside of the work that had to be done, and then there's the enormous amount of work at every site that BBN shows up at, and BBN couldn't do that work because it's peculiar to each host. So it was a fairly severe commitment to sign up for it.

But enough people did that first year before I could get a program manager, in fact. That I knew that once I could get a program manager it was going to fly. But I spent most of the first year just trying to get some support for it. One [touring] award winner, who I'll not tell you what his name is, but he said, "Well," -- I told him about it and he said, "Well, it's a mildly interesting engineering thing to do, but it's not the kind of thing Arpa ought to be doing. It's not researching."

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Oh, really?

And there were other, sort of, "Well, perhaps," and the initial response was not as good as I would have liked, but it worked out all right. Larry Roberts, himself -- have you talked to him yet?

Yeah, yesterday.

When I talk to him today or when I hear him talk to other people, it sounds as though he wanted to do something like this all his life. But in fact, he wanted to work on graphics at Lincoln Lab and he had several interesting projects going which were Arpa supported. But I wanted him for the program manager for this task because he had all the right background -- technical background. And he was mildly interested in it. I convinced him to do an Arpa supported sort of a sub-project with -- he chose Tom Merrill's Computer Corporation of America as the contractor. But I said, "Look, I want to do this network, you know, that I've been talking to you about." And this was before I had the project approved by *C. Hertzfeld*, who was the director of Arpa at the time. But I said, "I'm worried about what the phone lines are going to do to the reliability of our connections. There must be some way we can run some tests. Sort of set up some phoney signal patterns and send them across country, say between Lincoln Lab and SDC, the System Development Corporation, ..., L.A. to Boston, and let's see what the noise characteristics are on the ..., and let's find out some other things too while we're at it." So one day he said, "Okay, yeah." I thought he'd sort of forgotten about it. We talked about it -- from the first time we talked about it, but one day he called me up and said, "Okay, we're going to do this thing with CCA." CCA, I said, "Tom Merrill, okay, I guess that's all right." I was hoping Larry would do it himself. And so they did it. And it looked promising. I mean, there were techniques you could use to avoid the fact that the lines were noisy. You could get a good or higher ... and better grade lines and so on.

That happened sometime in '65, but I can't remember. Maybe Larry told you when he actually did the study. But the talking about getting the study done happened in '65. In February -- I know that, because in February of '66, I went in to see Hertzfeld, Charlie Hertzfeld, the head of Arpa. He since has told people --

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I read this some place -- that Arpa was one of the few places, maybe the only place in Washington, D.C. in those days, where you could go in with a good idea and 30 minutes later come out with a million dollars. And that's exactly what happened to me, except it was 20 minutes, not 30. But I went in and I said, "There's this project I want to start." And you know, I took him through the three terminals. He'd been in my office. He knew what that was like. Took him through that scenario. He said, "It seems to me there are several advantages if we can make this work. One is that we can put specialized areas of common knowledge." That is, specialized areas of knowledge where there may be several people in one geographical area and another several people in a different geographical area, but in the same field. And much better touch with one another in terms of working cooperatively. Both through E-Mail and through the fact that they can share programs and data. So that's one advantage is sort of overcoming geographical boundaries for joint work. Another advantage is that if you can make this work, we will be definition have made it possible in an interactive fashion for computers of different manufacturers to connect and that's a big plus. The defense department was the biggest at that time. Was the largest user and buyer of computing in the world. And so they -- so many of these purchasing operations in ... were in a quandary. They invested -- let's say the Navy had invested a fair amount of money in one manufacturer and now it wanted to upgrade its stuff. Is it bound now to that manufacturer? How do you get out of that bind? And all the services had that kind of a problem. And then there's the government accounting offices which was saying wait a minute. You've got to give equal opportunity to all of these manufacturers. It was a mess. So just that argument alone might have been enough to convince Hertzfeld. I'm not sure. But then there was another area. A third area that was more of a defense -- even more defense related. That second area could be used for the government in general, not just in the defense department. But the third argument was that it might be possible in the way we went about this network to connect it redundantly so that if lines were down - - this is back to my fear about the telephone connections not being reliable -- if lines were down, we had multiple pathways whereby it would fail softly, instead of just completely sort of one [note] or line connection was down, well, you could go through a different routing and still maintain. no de

So it was honestly about a 20 minute conversation and it ended when he said, "Great idea. Get it going. You got a million dollars more in your budget right now. Go." So I went.

And this was 60 --

This was February of '66.

So then what did you do?

By the way, one point of confusion here is that people used to speak of this community of folks around a single timesharing system as a network. But it's not at all the network that I had in mind. It differs in a lot of respects. The single network -- the single timesharing system network, of course, is just one computer. So that -- you understand. Lic, in one of his -- either in one of his papers -- maybe we did -- we drew our paper together. You must have a copy of that.

You know, I think I don't.

Well if you remind me, I'll look and see if I've got a copy here to give you, and if not, I can mail it to you. I've got plenty at work. I forgot about that.

Anyway, either he by himself or we together -- I can't remember -- had used the phrase once upon a time -- what was it? "Ended a crescendo of intergalactic bugging," or something like this. And the context was users all over the universe connected to one timesharing system. Not the model that you and I are talking about. Well people had -- this is back to all these stories that I've heard about how the Arpanet got started. So I've heard stories that connect the story of the Arpanet to that concept which, of course, is not true. And consequently, I've heard stories connecting the starting of the Arpanet to 1962, which is not true, because that's when Lic opened the Arpa -- that's when he went to Arpa ... Another -- this is a tangent. I'll try to stay away from tangents. But one thing that has really bothered me about all the histories that I've read is they've all missed the significance of Lic's going to Arpa. The world would be a different place today if that hadn't happened. Just an enormous

impact by him -- just by him alone. And his MIT technical colleagues because Lic himself wasn't computer -- you know, he wasn't a designer of operating systems or computer architecture. They've not given him proper due. He did things that those -- that a lot of those brilliant computer designers couldn't have touched with a 40-foot pole. Just by bringing that stuff into existence. Anyway, just a minor annoyance. Maybe not so minor ...

Okay. So you ask me what did I do after getting permission from Hertzfeld to get this thing off the ground. Well that's when I started talking to Arpa contractors -- my contractors about getting serious. To try to set up the necessary notes, connectors, users. An then I also now got serious about recruiting Larry Roberts.

How is it that you had your eye on Larry Roberts?

Because the program manager for this job needed to know a fair amount traditional electrical engineering as well as about computing, and that wasn't an easy combination to find in those days. He got his degree in Electrical Engineering from MIT. He had some interest in communications. The kind of stuff he was working on, you see, involves communications, but of a very local kind. You've talked to him about his 3D-ROM?

Yeah.

So you understand. And I thought he was a good, solid, hard thinker. I liked the way his mind worked.

You knew him?

Yeah, he was one of my contractors.

He was at Lincoln, right?

Right, and Arpa was supporting most of what Lincoln did. My contractors -- my set of contractors was the obvious set of people from whom to pick someone. I mean, I guess I could have gone outside that community, but that would not have been so obvious, and probably it might not have worked. I should give you more context. Every year, beginning with Lic Lighter and carrying

through my tenure at Arpa, the head of the office of the Arpa office -- the Arpa Information Processing Techniques office. When I say Arpa, I'm talking about the computer research part of it, unless I talk about Hertzfeld who was the head of the whole thing. So you may have to get me clear. Anyway, every year the head of the computer research part of Arpa, called Information Processing Techniques, would convene a several day meeting of all the principle investigators and sometimes other people for all the contracts that was going on. Maybe you've heard people tell you about this.

About these principle investigator meetings?

Yes. So these folks got to know one another a bit, and the head of the Arpa office would also get to know them. This is about during my tenuring way and also during Lic's and Ivan's. I don't know about later so much. We visited -- I visited all my contractors several times a year. There weren't that many of them. And I would spend several days at each one talking not only to principle investigators, but in my case, especially to the graduate students. And I started fairly early on a different principle investigators annual meeting with just the graduate students for --

In Illinois?

That was where one of them was, yeah. And I didn't permit myself or anyone over 30 to go to these. So Barry Weslor went representing Arpa and me. So anyway, that was another mechanism about which people got to know one another. So these are all reasons why it would make a lot of sense to pick someone from within this group. But Larry was doing a lot of other things, technical things, that had nothing to do with networking, (A), and he wanted to continue doing that, and (B), he didn't -- I think he saw the Washington job more as a bureaucratic job and less as a technical job, and certainly was less technical than what he was actually doing at the time. So he just said he didn't want to do it and he said it repeatedly. Occasionally, I would talk to other people and say, "Well, Larry doesn't want to do this thing. I can't think of anyone else that I would really put in that class." And so people would suggest names to me. I'd say, "Yeah, that's plausible, but I don't think he's as good as Larry." And then,

you've heard this story, I'm sure, by now. I believe I told you on the phone the other day. But one day in about October, I think it was, or November, I realized -- it dawned on me. Wait a minute. Arpa's funding 51% at least at Lincoln Lab, I think. I'll go see Hertzfeld. So I said, "Charlie, is it true that Arpa's funding 51% of Lincoln Lab." He said, "Yes." I said, "Well you know this project, this network I'm trying to get off the ground. I can't the program engineer I want to come run it." And so he said, "Who is that?" I told him. I said, "Would you call Jerry Denean and tell him to call Larry Roberts into his office and tell Larry Roberts it would be in Larry Robert's best interest and in Lincoln Lab's best interest if Larry Roberts came down here and did this job?" Charlie said, "Sure." He picked up the phone while I was in the office and he called up Denean and he said that and Jerry said, "Sure." And Charlie hung up the phone. It was a short conversation and he smiled at me and said, "Well okay, we'll see what happens." Two weeks later, Larry accepted the job. So I've said publicly in a symposium ... UCLA, with Larry sitting on the podium -- I think I told you this, didn't I?

Right.

That I blackmailed him into fame.

Well you didn't really blackmail him specifically. It was more Lincoln that got kind of vaguely threatened.

Except Jerry Denean and Charlie Hertzfeld were good friends. And I've since talked to Jerry Denean and he remembers it and laughs. Well he thought it was good for Larry too. At the time it was a good opportunity. And Larry was pretty young and not --

He was 29.

[Side 1 ends.]

[Side 2 begins.]

Right. I think Charlie placed that call in November, I think, and about '66, and during the Christmas holidays of '66, Larry and his family came down and stayed with me and my family at our house in Maryland while they were looking for a house or maybe while they

were waiting for the people whose house they had bought to move out. I can't remember. But I think they moved into their house in Virginia in January of '67.

So you must have gotten pretty close.

Uh-huh. Well I mean, I worked with him for a number of years.

What kind of guy is he from your point of view?

Can you ask me a more focused question or give me multiple choice answers?

Well he struck me as rather -- a little bit aloof, private.

Yeah, he's a little shy.

Very smart, quick.

Uh-huh.

And I've heard other say that. Those are my impressions. How about when you first met him? What were your impressions?

I don't remember what my first impressions were, but those are all consistent with the way I think of him. He's -- if you want to engage him in kind of a complete conversation, you have to sort of drive it. In other words, you have to ask him questions. He's responsive under those conditions. We had some problems associated with -- I mean, these weren't problems that got in the way of working with him. At least not from my standpoint. I hope not from his. It's not clear to me that if he ever had any troubles working with me that he'd ever say anything to me about it. I couldn't tell. I don't know. But anyway, there were a couple of things about the network design that were important to me. One was that it have a very short reaction time from a user's point of view. That is, that the user should be able sitting at any site to get into and work with the resources at some other site with less than a second delay. Which was a pretty good trick in those days, but Larry -- the design -- both Larry and other people helped make that work. And so that really wasn't a point of contention except

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that it was a difficult assignment. But at some point, early on, I was talking to Larry about routing and scheduling; that sort of thing. And he had -- either he or Network Analysis Corporation -- I can't remember which -- had the idea that we would run this thing from some central computer in Kansas or Nebraska, somewhere in the middle of the country. And I said, "That's got to be wrong." So I talked to Lic Lighter and Wes Clark again. I said, "What do you guys think of this -- of that idea?" And they didn't like it either. And I said, "I think I'm going to have trouble convincing Larry that this is a bad idea." Because I think that Howie Frank, of Network Analysis Corporation, was also in favor of this, and it could have been his idea. I can't remember whose idea it was.

You mean a staring network?

Well yeah, sort of, uh-huh. I mean, you could do a star network with redundancy, but that was an idea that I've heard Larry, even when I've asked him about it later, admit to briefly was a consideration, is probably the way he would put it. However, when I mentioned it to Wes and I said, "I'd like for you to talk to Larry." Wes had a lot of influence over Larry. Wes was sort of a senior computer designer around Lincoln Lab when Larry was a graduate student. Wes had a lot of influence over a lot of early pioneers.

Including Severo.

Oh yeah, and Idol(?), and Lic Lighter, and me. So we were at one of these Principle Investigator Meetings, I think, when I had this conversation with Wes, and as it turned out -- or maybe it didn't turn out. Maybe I arranged it. To be in a car on the way to the airport from this meeting -- I guess it may have been a meeting at the University of Michigan. I can't remember where it was. But anyway, we were out of town. We were out of Washington some place. And in the car was Wesley and Larry and me and somebody -- one or two other people. I can't remember who. And Wesley, bless his heart, started talking about how this network scheduling and distribution ought to work. And in this car, some people say it's a cab ride to the airport. I can't remember if it was a cab or it was probably a rented car with me driving is probably what it was. That's what we would usually do. But anyway. This story's been

told in this community a few times. On the way to the airport, Wesley designed the IMP for Larry.

Was anyone writing anything down?

I doubt it. I think he was just talking. I certainly wasn't writing it down. I'm pretty sure I was driving.

Do you remember what he said specifically?

Well he said, "You should have distributed productivity and at each site you could have a small computer that would look toward -- it would have two faces. One face would look to the host. The other face would look at all of its cousin small computers." And I think he even named it "Interface Message Processor."

I've heard that, right. So thus was born --

... Wesley has this wonderful sense of humor. Have you ever met him?

No.

You really got to go talk to him. He's great.

He's in New York.

Yeah.

Right, and thus was born the idea of isolating the IMP's from the host. Is that right?

Uh-huh.

And Larry said, "Oh, great." Is that what happened?

I think so. But I can't remember really. I don't think he argued with him very much. What does Larry say?

We didn't oddly enough talk about that yesterday. I don't know why. Because I meant to ask. Because what you say jives

completely with what I've heard from other people. Yeah, I'll ask him.

See, Larry may be -- may feel that people took too seriously this centralized notion and I might be, from Larry's point of view, one of those people, but I don't know.

What was the problem with a centralized notion?

Well, big machine, centralization, which is almost a philosophical thing by this time, if you'll go back and think about batch processing and priests(?) served that are in between users and the computing that they're trying to use. Redundant -- lack of redundancy. Okay, fine. Well you can put several duplicating machines all in one place. Wes had this -- Wes was not a fan of timesharing either, by the way. He was opposed to it. He said, "You need big computers for big computing, small computers for small computing, and individual people as individual users typically do small computing. So why have time share?" He designed and built a beautiful machine called Link.

This is the one he built with Severo?

Yeah. That was a biological laboratory machine fundamentally that biologists who didn't necessarily know much about computing could order this kit and put it together himself and use it as a direct interactive machine. But it wasn't a big enough machine to support a timesharing system and therefore support simultaneous users alike, because it was sort of a single user machine. And of course, ultimately we went to that. That's what PC's are. So if the Link would fit on your desk top, they you could argue, and Severo has, even though it wouldn't fit on the desk top, that Wesley was the guy who invented the PC.

Yeah, Severo mentioned that.

It's not a bad argument.

But we digressed. Where were we?

So we got Larry to Arpa and you got the IMP figured out and what

was next? I guess somewhere in there we -- after we figured out the IMP, we wrote a spec, and there was a fair amount -- there was some small amount, I guess, of pressure from within the elements of the DOD to use traditional DOD contractors to respond to the spec. So that you could have then a better pipeline directly into the military. Once the contractor succeeded in this research project, then it would be -- if it were a traditional military contractor, then it would be easier to take the technology and put it into a service of the military. But the traditional military contractors didn't know anything about this community that they were going to have to interact with and work with rather closely to make this stuff work. I'm talking about the people at these Arpa sites. BB&N folks knew those people pretty well. But we couldn't sole source it, because the government procurement regulations wouldn't let us. So we held a bidder's conference and we wrote ARFP(?) and we put it out for a request for proposals, and as it turned out, we could justify BB&N's response because it was technically superior in ways that were pretty easy to point out to anyone who wanted to ask to the other ones. So we chose them.

I've heard various stories. I've heard that BB&N was kind of favored from the start.

They were by me, yeah, for that reason. But I couldn't give them the contract. No.

Did they know they were favored by you?

I didn't tell them that. Because I wanted them. I was worrying about them being over confident. What was important to me was that they write a really good response that would blow out of the water anybody else's response. And I had no idea what other people might say or for that matter what BB&N might say. I could easily imagine them saying, "Well, we're part of the Arpa community." You see, because they had the Arpa contracts. And so this is a shoe in for us. So to the extent that I talked to them at all, I said, "This is an open competition, and I hope you guys do well," but I would say that to other people too.

How many of these open competitions did you do?

Now tell me about first of all the primadonnaism on the part --

Okay. Many of these contractors were universities. The labor at these university contractors were graduate students. You don't have any real control of graduate students. You can't say, "If you don't get this done by 5:00 this afternoon, you're fired." And sometimes graduate students can be prima donnas, but more likely a professor can be a prima donna. So the professor is expected to get his graduate students to do XYZ by such and such a time, and the professor has all kinds of reasons why he can't do that, and there's -- you know what a professor's life is like. There are all kind of tensions on his time and his committees. This is one more added thing. So the whole idea -- I mean, you could expect BB&N more or less to build a schedule and adhere to it. Even they had problems meeting schedules sometimes. But it was hopeless if you expected university groups to build and adhere to the same kinds of schedules. So you have BB&N ready to come into a university to put the IMP in place and the other side wasn't ready. So you'd have delays and that cost money. So you'd have people on site and they're just going to have to hang around for a week. "Well I guess we better leave the IMP here and take these people. Instead of leaving them here for a week with nothing to do. Figure out where they can go and be usefully employed until this university gets its act together." A lot ...

Right. Well I've also heard that there was kind of just overall resistance on the part of the ... to have someone ... come in and say, "Okay, you're going to have this thing. Gonna have this network."

There was some of that and that probably slowed us down, but it didn't stop us.

Now who did you all enroll at ARPA once Larry got there? How long did you then stay at ARPA?

Stayed until September of '69, when we had the first three nodes up and running. That's why -- that was the target I had set for myself to leave.

And to go where?

I didn't know where, but I went to Utah for a year. But I didn't know where I was going when I set up the target.

Why did you decide that you should leave then?

Cause I'd been there five years almost and it's not the kind of job that someone should be in for very long. It's not good for the person and it's not good for the field. It's a czar's job. You can do pretty much what you want as long as it's more or less sensible. You've got a lot of money at your fingertips. You've got a lot of influence. And if you stay in it too long, you get addleheaded, you get warped. Your perspective gets warped. People won't tell you what they think, what they really believe, because you're too powerful. And there are also lots of pressures. In my case, several things happened after Larry came. One is the behavior science office at ARPA fell apart, and I have a master's degree in experimental psychology, so the head of ARPA asked me to be the director of that office at the same time I was director of the IBT office, and I agreed to do that for a short time until we could get it pulled back together. And furthermore, the Vietnam war was heating up and Johnson was trying to run it out of the White House and there were individually different logistics reporting systems back to the White House for the four services. The Army had its own. The Navy had its own. The Air Force had its own. The Marine Corp had its own. So for the amount of captured material or the amount of bullets that were in supply or the amount of food that was in supply, the whole logistic support arrangements for the four services were totally uncoordinated. So Johnson would get reports that would say that the Air Force captured this much sugar from Vietcong this week and the Army captured this much and the Marine Corp captured this much, and you add it all up and it's more than the world's supply of sugar. So it didn't make any sense. You'd get reports that the Marine Corp was out of bullets. And so his guys would ask, "Well does the Army have any bullets?" "Yes, the Army has plenty of bullets." "Well what the hell is the Marine Corp doing out of bullets?"

I've lost the thread.

So Johnson got frustrated. He said to McNamara, "Something's seriously wrong here." McNamara said to the head of ARPA, who was

the only sort of fast response operational element that the Secretary of Defense had other than in one of the four services. "Don't you have someone that could fix this?" And the head of ARPA thought this is a computer -- this is an inventory control and computer related problem, and so he says to Taylor, "There is this problem. Go to Vietnam and see if you can fix it." So I had another duty that he gave me and so I went off to Vietnam several times. And after the first time, came back and put together a team of people that I then went back with it and didn't stay with them, but went back and forth a few times and they fixed it. So I had other things to do besides -- is the point of this story -- besides running the Arpanet Project. You asked me what else I was doing.

So this was after Arpanet? I lost track of the time. When was it that you got these orders to go to Vietnam?

'67.

Oh, so it was before then.

'66-'67. It was between '66 and '69 when I made several trips there over that time period and discovered in the course of it that we were in a Civil War. I'm getting back to why -- all the things that contributed to my leaving Arpa apart from my five year target. Became pretty disenchanted with the whole Vietnam -- with our engagement, with our involvement, and that helped me to leave. Nixon's election helped me to leave.

Yeah. Bad time to be working for the government. Or a good time. What was Arpa like in general? It seems that it was really -- what's so fascinating about it to me is that it was a bunch of interesting thinkers.

For a while. Bob Sprow was the director of Arpa -- of all of Arpa, when I worked there, and he was wonderful, very bright. And Charlie Hertzfeld was his successor and so was he. Bob Fraush was in there at some point. But maybe after Everhart left. I can't remember. Bob Fraush was a very sharp guy. Later he was head of NASA. Today is head of General Motor's Research. So there were a lot of really good people there and there were statesmen as well. Go to the Congress and say, "Look, this particular research

investment is not just good for the Defense Department, it's good for the country and here's why."

Why and when was Arpa formed in the first place?

| In 1957, there was Sputnik.

So in response ...

| Sputnik surprised people. And Arpa was created to avoid further surprises. So it moved all the space stuff that it started. It started a bunch of space programs between '57 and '60, and NASA was ... Moved all those things over to NASA and Arpa started a few new things. In '62, computing was one of the new things that started, and the face of computing hasn't been the same since.

When did it become Darpa? Under ...?

Yeah, I think so. It's Arpa again now.

And now it's Arpa. Right. Boy Clinton wasted no time. Now everyone I've talked to has said that they are surprised, to say the least, at what the network has become. Obviously, the Arpanet, per se, no longer exists, but it has evolved into this rather -- it's almost overwhelming.

Well it's interesting. First of all, that triggers three responses. I'll try to get them quickly. Everhart Rekton(?), I believe is he, Director of Arpa, after I left, I think pressured Larry to move the Arpanet context out of the research context and into an operational context.

That's right. After it was clear that it was operating.

Well if I had stayed there, I would have argued the following and to this day believe that what should have been done was fine, move it off. Create an operational Arpanet, if you will, separate from the research Arpanet, and leave the research Arpanet in place to attack the graphics problem. That is to say, the thing that was not done that should have been done, and that I would have done and wanted to have done, had I stayed, was to extend the Arpanet so

that you could have graphical interaction over long distance and not just character ..., and that research was never done and still hasn't been done to this day. Although we're doing it now with ATM related stuff. But we could have done some really good things, I think, a lot earlier. So that's one bone of contention I have about how it unfolded.

So today, we have this Internet phenomenon, but in 1969, when we had these three nodes up and running and I knew it was going to work as result of that, I believed and would have predicted if anyone asked me that by 1979, let's say ten years later after '69, we would be roughly where we are today with the Internet. So I don't --

You're not surprised.

No, in fact, I'm disappointed. Now I realize in retrospect that a lot of things had to happen that had nothing to do with networking research, per se, to bring us to the point of the Internet today. And these are mostly PC related kinds of things. And of course, I'm pretty disappointed about the way that's turned out too, but that's a whole other story, right? Because I was involved in what should have been the first PC work in '74.

At Park, uh-huh.

Yeah. So I have several reasons to be disappointed and they're connected.

And you said you had third --

Well right. Third was the connection to the PC world. Second was the '69/'79 prediction. Third was the connection to the PC.

[End of tape.]